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# Community energy planning in Canada: The role of renewable energy

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ABSTRACT

An emerging trend in Canada is the creation of community energy plans, where decisions that used to be left to regional level energy agencies or private individuals are now being considered at the community level. A desire to reduce greenhouse gas emissions and to become more energy self-sufficient is driving this change. Theoretically, local level management is desirable because it achieves these goals through improvements in the three areas of energy efficiency, energy conservation and switching to renewable energy sources. The analysis of 10 of the first community energy plans in Canadian communities, ranging in population size from 500 to one million, finds that communities are choosing policies and programs centred on increasing energy efficiency and conservation while renewable energy receives much less attention. Municipal operations were called upon to set higher targets than the general community. Communities that recognized the substantial potential of renewable energy often focused on technologies that the municipal sector could implement, such as bio-fuels for their transportation fleet. Wind, passive solar design, solar photovoltaics and solar thermal options were only recommended in a few cases. Overall, only one of the five larger communities (Calgary) recommended implementing multiple renewable energy technologies while three of the five smaller communities proposed multiple renewable energy sources. The implication is that smaller and more remote communities may be the most willing to lead in the planned introduction of renewable energy systems.



**Contents**



## 1. Introduction

Energy has traditionally been managed at the level of the individual customer or by regional/national utilities. A recent trend is for communities to create plans to directly manage their energy systems. These local initiatives are heralded as precursors to a future network of distributed generation where large central generating stations are replaced with many dispersed and smaller generation sources. Motivations for this shift in management include the desire to reduce greenhouse gas (GHG) emissions, to limit exposure to rising prices for centrally generated electricity, or to shift to a more self-sufficient energy system. Essentially a move away from the regionally directed approach to a locally designed

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approach is occurring in parallel to the rise of the city as a key player in the global economy. Questions of interest include: What is the mix of energy policies selected? Do these new community level energy plans create a mechanism for promoting renewable energies as a central part of the community's energy mix?

Generally speaking, there are three areas in which communities can focus in order to improve their energy systems: energy efficiency; energy conservation; and the switching of energy sources to renewables. Energy efficiency is simply defined as "the useful energy output divided by the total energy input" [1, p. 94]. It refers to how well the supply side performs in ensuring little waste of energy in generation and delivery, as well as, the demand side of energy management's ability to perform desired services with less energy input. Energy conservation is defined as any measure made to reduce the amount of high quality energy that is demanded to provide goods or services [2]. Demand side management (DSM) includes many techniques to increase energy conservation. The switching of energy sources to local renewable energy generation helps to ensure that supply meets demand with the further benefits of causing less environmental impact than non-renewable sources, and being more sustainable in the long run as, by definition, they are from a regenerative source (e.g. wind and solar energy) [1,3,4,5].

Conservation, efficiency and renewable energy technology together were shown in a 2006 federal government sponsored study to have the potential to reduce the increase in Canadian energy demand (excluding the transportation and energy producing sectors). This reduction was estimated to be between 16% and 56% by the year 2025, depending on the levels of program support from governments [6, p. 9]. The mix of these three approaches in energy plans – efficiency, conservation and renewable energy technology – reflects the community's values, knowledge and intrinsic capacities. Of particular interest to this study is the relative role renewable energies are given in communities' planned energy future. Is the conclusion that "one hundred percent renewables is doable" reached by Brent Kopperson, one of the co-organizers of the World Wind Energy Conference held in Canada in 2008, being adopted at the local level [7]?

The next section explores the concept of managing energy and how communities make energy plans. It is followed by case studies where the approaches to community energy planning and the resulting action priorities are examined in 10 Canadian communities.

## 2. Managing energy for communities

To manage energy involves ensuring both the demand and supply sides of the energy equation work in balance. Energy management is an intricate task requiring advanced science technology and knowledge, and the "development of complex organizations and managerial systems" [8, p. 391]. At the regional level an autonomous decision-making system is in place to maintain this system, requiring and requesting little community involvement to operate. Since the 1970s communities have become better equipped to act locally and plan their energy systems themselves [8,9]. In part, this empowerment is the result of advances in technology and increased knowledge on how to manage energy supply and demand. It is also due to more being known at the local level on "what to build and how to build it" [9, p. 61]. This newer form of local level management typically occurs with much greater social input than the regional directed systems [8]. A community-led managerial system seeks not only to incorporate citizens' ideas and opinions, but also engage them as active stakeholders in the multiple areas of energy production, delivery and consumption. Community energy is the term often used to describe this form of community-led energy management.

There are advantages to having community energy as the system that makes a community whirl and hum, rather than a regional directed approach. According to Hoffman and High-Pippert community energy offers a "serious alternative to the current energy system" [8, p. 387] which incorporates participation of locals and hence offers a system concurrent with local needs, values and resources. Lerch [9] also points to the capacity local level governments have in being more agile to respond to opportunities and threats that the energy system might face. Furthermore, Lerch notes that the local people planning these systems are personally invested in their outcome as they are members of the community themselves. This can provide motivation for community energy initiatives to be more than just plans and become actual actions. These actions are further enabled by the community members' ability to see local details and tap into local resources found in the business and civil groups, education institutes and other government bodies that can support their community energy goals [9].

Community energy is also advantageous as it allows for the "establishment of a clear link between local generation and local consumption" which in turn can be beneficial in reducing the negative impact energy generation and consumption has on the environment, economy and social aspects of the community [8, p. 393]. In particular, "people will want to make choices that do the least harm to themselves, their families and their communities" [8, p. 393]. These ideas affirm a community energy approach to energy management that considers more than demand and supply in isolation. A 'triple bottom line' that seeks economic, environmental and social net benefits is often implicitly or explicitly considered. Nilsson and Martensson support this definition with the claim that community energy systems are to be "based on the effective energy use and supply with low impacts on health, the environment and the climate" [10, p. 181].

## 3. Moving towards community energy

Communities can move towards the community energy approach to managing their energy by becoming active participants in the energy supply and demand processes. One way communities can do this is simply to join with their regional distributors and together design more locally acceptable energy system plans. However, there is no guarantee through this method that communities will influence the regional distributors significantly or in a way that is suited to their communities' needs [8]. For this reason communities may choose to take an alternative means to becoming more influential stakeholders. These communities choose to embrace the idea of energy management and set forward through local planning and decision-making to create community energy plans that specifically address how local demands will be met, and which supply sources, distribution means, efficiency improvements and conservation methods will be used. The Council of Energy Ministers in 2007 stressed that CEPs were one of the "tools to advance energy efficiency" that municipal and local administrations can use [6, p.14].

With its holistic goals of providing benefits for the economy, environment and society, community energy plans are known in their applied context by numerous names. Under these names they are being created by communities as either a separate plan or as a part of their overall community or sustainable environment plans. 'Community energy management' (CEM), 'community energy plan' (CEP), 'local action plan for climate change' (LAP) are all names given to the documents communities prepare to establish guidelines for their community energy system. Essentially, each of these

community energy documents support community participation in the energy management process which, summarized by the Arctic Energy Alliance [11], is "a combination of technical processes and/or behavioural changes that ensure maximum comfort for the occupants of a building or home, while limiting energy expenses and environmental impacts." A 'community energy plan' is termed by the Arctic Energy Alliance [12] as "a planning process that helps a community identify and address its energy needs." The term 'community energy management' is similarly defined by Jaccard et al. [13] but is detailed more in scope as being the concept of strategically planning for a community's energy needs and use to result in the implementation of efficient, economical and environmental energy systems. 'Local action plans for climate change' (LAPs) in Canada have developed from the Federation of Canadian Municipalities (FCM) and Local Governments for Sustainability network of Partners for Climate Protection (PCP) program where their member communities are being urged to act on climate change at the local level, incorporating into their local action plans details for local energy plans. (It is noted that not all LAPs take on the task of an entire community energy plan, some focus on only one or a few projects to reduce their municipal GHG emissions.) The term 'community energy plan' (CEP) will be used in this paper as the general term to describe all community-led energy management plans.

The role of renewable energy technology (also more simply referred to as renewables) in CEPs has been highlighted by several authors and organizations. Lerch stresses that community energy systems need to include plans that explicitly include "[generating] energy from clean and secure sources by developing local wind power, solar power, distributed generation and regional bio-fuel production" [9, p. 60]. Jaccard et al. promote the use of renewables with the comment that within CEM they play a key role along with conservation in "fostering efficient and environmentally benign energy supply and delivery systems" [134, p. 1066]. Similarly, Natural Resources Canada sees CEPs as helping communities to be less dependent on "the conventional energy market" [14, p. 8] implying renewable energy sources are to play a role in fulfilling communities' needs along with plans for increasing efficiency and conservation. Moreover, plan design suggestions by the ICLEI (International Council for Local Environmental Initiatives) [15] call for any implementation of energy plans to include considerations of efficiencies and renewables. The movement of cities to use their energy planning as an element in their post-carbon community plans similarly stresses renewable energy technology as part of the solution to deal with predicted high oil prices and limited fossil fuel supplies [9]. In summary, the literature identifies renewables a significant part of CEPs. The next section looks at how this identified role from the literature compares to the actual contents of Canadian community energy plans.

## 4. Case studies

Recent CEPs are investigated to determine what types of actions communities are embracing and to assess where renewables are on the community agenda compared to increasing energy efficiency and conservation. Patterns and priorities expressed in CEPs are identified by reviewing the documents recently published in Canada by 10 communities. These documents represent the publicly available CEPs and are important because many more communities are expected to follow these early adopters and articulate their own energy goals and priorities in the near future. The communities each produced a CEP in the 2003–2007 period and varied in location, population and whether they were remote, rural or urban. Table 1 lists the names of the communities, their population and the GHG emissions reported in their energy plan. However, the procedures used in plan preparation varied, so caution is required when comparing GHG emission levels. For example, transportation and industrial emissions may not be treated consistently across communities. The national average of 22 tonnes of GHG emissions (in $CO_2$ equivalent or $CO_2$e) per person is provided as a reference point [16,17].

From the community energy plans reviewed, the findings can be divided into three categories for discussion. The first of these categories, *initial planning process* investigated how the community approached the planning of their CEP. What motivated them to develop a plan related to energy? Who coordinated the task: a local actor or group, or outside expert? Furthermore, to what extent did the community participate?

The second category, *plan dynamics*, considered how the plans were designed to function. It also sought to discover the goals of each community, the desired economic, environment and social benefits, and GHG emission reduction targets. The last category, *demand and supply* investigated the details of the energy plan in terms of the community's relative focus on the demand side or the supply side of the energy system. This section offers the most information for discussion as it evaluates how the plans incorporated the concepts of energy efficiency, energy conservation and renewable energies.

The cases studied are not a complete evaluation of this subject given the limitations found in the CEPs themselves. Each is individualized to the attributes of the local community and, therefore, unique in its documentation, procedures and approach to community energy planning.

**Table 1**
The 10 communities.

| | City, province/territory | Population | Total GHG emissions (tonnes $CO_2$e) | Tonnes/capita | Year of data |
|---|---|---|---|---|---|
| 1 | Calgary, AB | 956,000 | 16,370,000 | 17.1 | 2006 |
| 2 | Vancouver, BC | 600,000[a] | n/a | n/a | 2005 |
| 3 | Halifax, NS | 350,000 | 6,782,121 | 19.4 | 2007 |
| 4 | Guelph, ON | 115,000 | 995,769 | 8.7 | 2007 |
| 5 | Pickering, ON | 94,200 | 678,612 | 7.2 | 2006 |
| 6 | Whitehorse, YK | 21,400 | 173,100 | 8.1 | 2004 |
| 7 | Yellowknife, NWT | 18,700 | 361,000 | 19.3 | 2006 |
| 8 | Banff, AB | 7,000[b] | 297,000 | 42.4 | 2003 |
| 9 | Deline, NWT | 570 | 5,830 | 10.2 | 2007 |
| 10 | Wha Ti, NWT | 500 | 2,505 | 5.0 | 2004 |
| | Canada | 32,649,000 | 721,000,000 | 22.0 | 2006 |

*Source*: CEPs [3,4,5,19,20,21,22,23,24,25], Canadian total data calculated from [16].
[a] The total is 2.1 million in the Vancouver region.
[b] Plus accommodation for additional 18,000 visitors gives 11.9 tonnes $CO_2$e/capita.

## 5. Findings

### 5.1. Initial planning process

The review of the community energy planning process revealed that all municipalities supported the CEP process; however, every plan also cited either information or incentives from larger organizations as a motivation for their community to undertake their CEP. The incentives were typically in the form of loans or grants to finance the plan's preparation or implementation. The information provided by central organizations came in the form of data analysis for evaluating current energy consumption and forecasting, as well as, information on the best practices of other communities that had already created CEPs of their own. The organizations driving the planning process from the national level were Natural Resources Canada and the Federation of Canadian Municipalities which used federal funds to operate the Partners for Climate Protection program [18]. The Kyoto Accord was also highlighted as an international agreement that motivated communities to take action. Some plans recognized professionals and climate change spokes people warning of the negative impacts of climate change as motivation.

Although the incentive to create CEPs came from national or international entities, the response to the opportunity to establish plans was taken up at the local level by a mix of civil servants, local organizations and external experts specifically commissioned by the local government to research and then generate a CEP for their community. The extent to which the community engaged the public as stakeholders in the planning process varied from community to community. In one case it was not stated if any public participation was invited at all. A limited number of municipalities (three) established a local citizen volunteer ad-hoc committee or incorporated an already pre-existing community group into the planning process as full partners which hosted regular meetings to collaborate on the development of the plan. Most of the CEPs included local participation in the form of public consultation with local residents and businesses through either: focus groups, consultation sessions, open houses, surveys, or workshops.

Beyond the municipal government, the primary stakeholders identified in each CEP were local businesses and residents. In most cases, these stakeholders were engaged to consider their energy needs and preferences. The external stakeholders considered explicitly in some CEPs were regional energy regulatory bodies, such as provincial government institutions.

### 5.2. Plan dynamics

Although the plans varied in their layout, use of charts, and tables, they were written to 'speak' to their municipal leaders, using a high level of language and implied understandings. Each of the 10 CEPs looked at community energy as a part of the community's overall plan for taking care of their local environment. This means that some plans included details on water resource management, as well as, plans for waste systems. Furthermore, all included two essential sections, beyond the introduction to their objectives and conclusion. The first of these sections was a baseline study that indicated by either use and/or energy type the consumption amounts or greenhouse gas emissions for the municipality (see Table 1). Each community distinguished their energy users by sectors – labelling them as residents, commercial/industrial/municipal, and transportation (with some grouping commercial and industrial users under the title 'businesses' and separating out municipal properties). The second section each included was a formal list of action items that the municipality should pursue to implement the plan.

In terms of the goals of the plans, the primary focus of each was to reduce their local level of greenhouse gas emissions. Only the remote northern community of Wha Ti combined this objective with the aim of becoming more self-sufficient in their energy supply [19]. Within the framework of economic, environment and social benefits, the communities varied in the elements they identified in the CEP. While the benefits for the environment and society were stressed in all CEPs in terms of the benefits that would be achieved from the GHG emission reductions, the only economic benefits stressed by more than one community were the benefits of job creation and energy cost savings.

Target amounts for how much the community planned to reduce their emissions were documented by all but two of the communities who, although they expressed their desire to reduce GHG emissions, did not set a numerical target. Seven of the communities split their target into two tiers with a specific and much higher GHG reduction goal for the municipality and a lesser target, usually 6% (equal to Canada's Kyoto target), for the entire community. Table 2 presents each community's GHG emission reduction goals. These targets were to be achieved through a series of action items listed within the CEP. However, whether these action items were the actual means by which the target could be achieved, or whether they were simply a call for more investigation into a specified area of interest, differed from community to community and within each by the idea proposed. The plans also differed between municipalities by the extent to which they included means to measure their advancement towards reaching their targets.

### 5.3. Demand and supply

Proposed actions were divided into demand and supply initiatives. The demand side initiatives were approached in the framework of energy efficiency and conservation. The case studies showed that the majority of initiatives on the demand side were designed to promote voluntary behavioural changes. Behaviour

**Table 2**
Community targets.

| | City | Year of plan | Baseline year for plan's targets | Municipal GHG targets | Entire community GHG targets |
|---|---|---|---|---|---|
| 1 | Calgary, AB | 2006 | 1990 for city; 2005 for entire community | 50% by 2012 | 20% 2020 and 50% by 2050 |
| 2 | Vancouver, BC | 2005 | 1990 | 20% by 2010[a] | 6% by 2012 |
| 3 | Halifax, NS | 2007 | 2002 | 20% by 2012 | 20% by 2012 |
| 4 | Guelph, ON | 2007 | To be determined | To be determined | To be determined |
| 5 | Pickering, ON | 2006 | 1995 | 50% by 2016 | 35% by 2016 |
| 6 | Whitehorse, YK | 2004 | 1990 for city 2001 for entire community | 20% by 2013 | 6% by 2001 |
| 7 | Yellowknife, NWT | 2006 | 2004 | 20% by 2014 | 6% by 2014 |
| 8 | Banff, AB | 2003 | 1990 | 20% by 2013 | 6% by 2013 |
| 9 | Deline, NWT | 2007 | 2004 | 20% by 2014 | 6% by 2014 |
| 10 | Wha Ti, NWT | 2004 | n/a | n/a | n/a |

*Source*: CEPs [3,4,5,19,20,21,22,23,24,25].
[a] Detailed in their *Corporate Climate Change Action Plan*, which is a separate document from their CEP

changes included electricity saving educational campaigns and the promotion of car efficiency by encouraging drivers to maintain proper tire air pressure. In the plans, regulations as initiatives to increase energy efficiency and conservation took on the limited form of mandating changes in building design for municipal properties, with only a few communities extending their regulatory actions to include designing new construction standards through alternations to the local building code and construction by-laws. Some CEPs stressed the important role that municipal governments can play at lobbying upper governmental bodies to exercise stronger regulatory control that would further increase efficiency and conservation. This included calling for stricter industry emission standards and the implementation of a carbon tax.

The supply side of the CEPs' action plans did not focus on making the existing centralized energy supply decentralized. The only exceptions to this were found in two plans that mentioned this could be a possibility for large new development sites. For these opportunities more research into how energy generation could be incorporated into the project's design was suggested (for example, the False Creek development site in Vancouver, BC [20]). The two remote communities of Wha Ti and Deline were already decentralized in their approach to electrical generation since it is not possible to connect them to the grid [4,19]. For these communities, the gains from becoming more self-sufficient were examined and the communities stressed the importance of local energy resources. For example, the use of a micro-hydro dam instead of a diesel generator was proposed for Deline because the diesel generator required imported fuel [4].

Renewables were incorporated into the energy management plans for the communities in two ways. First there was a stress by many communities on the important role education and awareness can play in seeing greater public acceptance of these technologies. Action items in the plans included educating residents and businesses about the types of alternative energy production options they could install, such as, solar walls or photovoltaic (PV) panels. Second, municipalities designed actions to lead by example. These actions included: using bio-fuels for their municipal vehicles, incorporating solar, wood and wind into the supply mix of their own buildings, and purchasing renewable energy supplies for the community by bulk purchase (Table 3).

Table 3 presents the renewable energy initiatives each community discussed in its plans and initiatives for energy efficiency and conservation by sector. This review of CEPs leads to several conclusions. First, a clear difference emerged between demand and supply proposed actions. On the demand side nine of the 10 communities proposed action for residential and municipal sectors while the final community proposed further investigation or research. The same pattern was repeated for the commercial sector, except in the remote northern communities where the commercial sector is very small. In contrast, all communities did not include recommendations related to renewables. For those that did, their action plans for the residential and commercial sectors concentrate on three things: building design; the incorporation of better wood burning stoves (in some northern communities); and the use of various forms of solar energy (passive, water and air heating, and PV). However, in the majority of communities, recommendations did go beyond these two sectors to include recommendations for the use of renewables in areas under the control of the municipality directly. The most common renewable energy source, proposed by half of the communities, was bio-fuels as an alternative transport fuel for their fleet vehicles. Wind, passive solar design, solar PV, solar thermal, and bulk purchases of 'green' electricity options were

**Table 3**
Initiatives recommended in CEPs.

| | Sector[c] and recommendation made (action vs. research) | | | | | |
|---|---|---|---|---|---|---|
| | Residential | | Commercial | | Municipal | |
| | Action | Research | Action | Research | Action | Research |
| Increasing energy efficiency and conservation initiatives | 1, 2, 4, 5, 6, 7, 8, 9, 10 | 3 | 1, 2, 4, 5, 6, 7, 8 | 3 | 1, 2, 4, 5, 6, 7, 8, 9, 10 | 3 |
| Renewable energy initiatives | | | | | | |
| New bulk purchase[a] | | 2 | | 2 | 7, 8 | |
| Wind | | | | 4 | 1, (10) | 3, 4 |
| Bio-energy[b] | | | | | 1, 2, 3, 4, 8 | 3 |
| Wood | 6, 9 | | 6 | | 7 | |
| Solar – passive design | 10 | | 7, 10 | | 8, 10 | |
| Solar – $H_2O$ and air heating | 1 | 10 | 7, 10 | | 1, 10 | 3, 4, 9 |
| Solar – PV | 1, 8 | 4 | 1, 8 | | | 2, 3 |
| Micro-hydro | | | | | 10 | 3, 9 |
| Large-hydro | | | | | | 7 |

*Source*: CEPs [3,4,5,19,20,21,22,23,24,25]. (#) Indicates the renewable energy type was discussed but deemed not feasible.
Where each number references a community's identity as per listings below (ordered by population, from greatest to least).

1 Calgary, AB
2 Vancouver, BC
3 Halifax, NS
4 Guelph, ON
5 Pickering, ON
6 Whitehorse, YK
7 Yellowknife, NWT
8 Banff, AB
9 Deline, NWT
10 Wha Ti, NWT

[a] New energy demand is to be met from green electricity purchased from the regional utility supplier.
[b] Includes: vehicle bio-fuels and gasification of bio-mass for electricity generation.
[c] Includes buildings and vehicles of each sector.

**Table 4**
Renewable energy initiatives by community for all sectors – recommended actions.

| | Community (arranged in order of population, from greatest to least) | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1<br>Calgary, AB | 2<br>Vancouver, BC | 3<br>Halifax, NS | 4<br>Guelph, ON | 5<br>Pickering, ON | 6<br>Whitehorse, YK | 7<br>Yellowknife, NWT | 8<br>Banff, AB | 9<br>Deline, NWT | 10<br>Wha Ti, NWT | |
| Renewable energy initiatives | | | | | | | | | | | |
| New bulk purchase[a] | | | | | | | ✓ | ✓ | | | 2 |
| Wind | ✓ | | | | | | | | | × | 1 |
| Bio-energy[b] | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | 5 |
| Wood | | | | | | ✓ | ✓ | | ✓ | | 3 |
| Solar – passive design | | | | | | | ✓ | ✓ | | ✓ | 3 |
| Solar – $H_2O$ and air heating | ✓ | | | | | | ✓ | | | ✓ | 3 |
| Solar – PV | ✓ | | | | | | | ✓ | | | 2 |
| Micro-hydro | | | | | | | | | | ✓ | 1 |
| Large-hydro | | | | | | | | | | | 0 |
| Total | 4 | 1 | 1 | 1 | 0 | 1 | 4 | 4 | 1 | 3 | 20 |

*Source*: CEPs [3,4,5,19,20,21,22,23,24,25].
✓ Action for renewable energy initiative proposed. × Indicates the renewable energy type was discussed but deemed not feasible.
[a] New energy demand is to be met from green electricity purchased from the regional utility supplier.
[b] Includes: vehicle bio-fuels and gasification of bio-mass for electricity generation.

**Table 5**
Renewable energy initiatives by community for all sectors – recommended research.

| | Community (arranged in order of population, from greatest to least) | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1<br>Calgary, AB | 2<br>Vancouver, BC | 3<br>Halifax, NS | 4<br>Guelph, ON | 5<br>Pickering, ON | 6<br>Whitehorse, YK | 7<br>Yellowknife, NWT | 8<br>Banff, AB | 9<br>Deline, NWT | 10<br>Wha Ti, NWT | |
| Renewable energy initiatives | | | | | | | | | | | |
| New bulk purchase[a] | | ✓ | | | | | | | | | 1 |
| Wind | | | ✓ | ✓ | | | | | | | 2 |
| Bio-energy[b] | | | ✓ | | | | | | | | 1 |
| Wood | | | | | | | | | | | 0 |
| Solar – passive design | | | | | | | | | | | 0 |
| Solar – $H_2O$ and air heating | | | ✓ | ✓ | | | | | ✓ | ✓ | 4 |
| Solar – PV | | ✓ | ✓ | ✓ | | | | | | | 3 |
| Micro-hydro | | | ✓ | | | | | | ✓ | | 2 |
| Large-hydro | | | | | | | ✓ | | | | 1 |
| Total | 0 | 2 | 5 | 3 | 0 | 0 | 1 | 0 | 2 | 1 | 14 |

*Source*: CEPs [3,4,5,19,20,21,22,23,24,25].
✓ Action for renewable energy initiative proposed.
[a] New energy demand is to be met from green electricity purchased from the regional utility supplier.
[b] Includes: vehicle bio-fuels and gasification of bio-mass for electricity generation.

each proposed as actions by only two of the 10 communities. Further research into one or more of these renewable energy technologies was recommended by five communities.

Tables 4 and 5 illustrate further which communities suggested each type of renewable energy initiative as either an action item or a planned area of research. Calgary, Yellowknife, Banff and Wha Ti are clear renewable energy leaders in recommending actions as their identification of these actions sharply contrasts with the other communities. In most communities the renewable energy technology typically identified was bio-fuel for the municipal transportation fleets in the cities and wood as a renewable fuel in three northern communities. A clear pattern emerged with Calgary and some of the smaller communities proposing action to introduce renewables while the other larger centres primarily recommended further research.

## 6. Discussion

The following section discusses the findings regarding process, targets and the role of renewables in comparison to energy efficiency and conservation.

The priorities municipalities set in their CEPs point to the pivotal role upper levels of Canadian government play in stimulating changes at the local level. Although grassroots organizations are commonly promoted as the best way communities can accomplish sustainable solutions relevant to their local context, there is still a need for a transfer of knowledge and the support of program funding from upper levels to get these projects moving. The CEPs demonstrate the influence of upper level government. The Council for Energy Ministers of territorial and provincial level governments in 2007 declared energy efficiency rather than renewable energy technology development as their primary means to achieve energy and GHG reduction targets [6]. Local governments followed the same preference in their CEPs. Whereas each community gave consideration to the area of efficiency, few considered renewables.

The construction of the CEPs in a manner that allows for outside input also indicates the important role networks play in promoting community energy. The knowledge communities can gain from their peers across Canada in how they dealt with similar community needs or issues is invaluable. In this way we see communities tapping into the power of social capital (typically

using professional networks) to accomplish locally designed goals. Therefore, there is evidence that networks of local governments, for example the PCP organized through the FCM, and other entities can use CEPs as a mechanism to develop the renewable energy market, or promote the use of renewable energy.

Communities also used outside expertise to overcome a lack of internal capacity and know-how to prepare CEPs. This expertise provides the technical knowledge required to create a starting point from which to develop a CEP. Municipalities need to work with these consultants to ensure that the advice bought is relevant to their community's resources and matches their objectives. This pattern also shows that there is an opportunity for outside experts to provide consultation not only on the creation of CEPs but also on the relevance of particular renewable energy options to local communities. In some communities there was evidence of this occurring, where the outside expert explained technologies such as solar walls, and how they could be applied to the community. There was not any evidence, however, to conclude that all outside experts were helping communities in this fashion even though this could be a significant means to move renewable energy higher on the local agenda.

Citizen participation at the community level was very mixed in the communities studied, with high participation rates only reported in northern communities. The established social norms of social inclusion and group consultation that exist in these communities are likely the reason behind this difference. While it is promoted in theory that participation by a community's members will lead to energy plans that show the utmost consideration to the environment and social health (since people will be unwilling to harm themselves or destroy their surroundings), renewable energies do not appear to be promoted as the solution that this theory and the literature implies.

As a CEP is meant to be formed by the community and implemented locally, it should be written with the intent of becoming a guideline for the entire community. We see, however, in the cases studied that the CEPs are written so that they speak primarily to municipal council. This can be a hindrance to their ultimate community application since it can restrict the general public from understanding what is being prescribed and citizens' participation is never fully realized. This holds especially true for communities that have citizens with diverse knowledge, language, and cultural backgrounds.

Goals of the plans were typically established in two tiers: local government and community. The bigger reductions in GHG emissions were tasked to the local government as, after all, the CEPs were written by the local government and they hold the most power to make changes in their own operations. In their designing of CEPs it is shown that municipalities are trying to promote the move towards GHG reductions by acting as leaders, demonstrating best practices for businesses in the communities. Their other aim is to spread behavioural changes throughout the community by starting with their own personnel who through their workplace will become knowledgeable on how to increase energy efficiency and conservation, and become acquainted with renewable energy technologies.

Renewable energy recommendations for action and further research are seen most prevalent in the municipal sector. Calgary's use of purchased wind generated electricity to operate their passenger rail transit system (hence their slogan 'ride the wind' [3]) is an example of both the local government taking action and raising renewable energy awareness among its citizens. However, not all communities are taking steps in this area. For those that are not, there is a risk that renewables will not advance in their use in any of the sectors, since there is no one championing them. Furthermore, if municipalities are considering their plans to be working documents, and that at some later point they will include renewables in a more prominent role in their plans, they are actually sending a message that hampers renewable energy development across the community. This is because their inaction tells residents and businesses that the time for renewable energy has yet to come and renewables are not important alternative energy sources at this time. By bringing renewable energy options to the table for discussion, municipalities can reverse this message and become the leaders their communities need in order to accept and implement renewables. Inaction or delaying action, means that renewable energy is relegated to watching the energy supply game from the sidelines, rather than be considered a central player.

The results show that communities are willing to be led by top-down mechanisms (e.g. FCM network or NRCan incentives) when it comes to mitigating climate change. Regional and federal governments have the opportunity to decide whether central policies promoting or requiring renewable sources of energy are the desired means to raise their profile in communities. At the local level, the CEPs showed that municipal governments are content to use soft tactics for both demand and supply initiatives, with regulations proposed in very minimal forms. This soft approach falls in step with how communities approach other areas under municipal governance, showing that although top-down regulation might be desirable in some cases, in others, communities prefer their energy system to be based on voluntary behavioural changes.

Overall, renewable energies are not very prominent in the recommendation section of the community energy plans. They are not viewed as a priority means to improve the local energy system, when compared to the efforts made in the CEPs to engage people in increasing energy efficiency and conservation. Their lower ranking on the planning agenda could be caused by several factors: the need for more information regarding renewable options, a lack of local capacity or funding, or the relatively low price of conventional electricity and fuel in Canada. Although the CEPs did not show all of the reasons (and certainly did not pinpoint the exact ones) why renewables do not rank higher on the planning agenda, the investigation did make their minor position clear in relation to efforts to increase efficiency and conservation. The exception to this pattern was bio-fuels (e.g. ethanol and bio-diesel) for transportation which were recommended in half of the CEPs. Next a closer examination is made as to which communities showed the greatest interest in renewable energy.

When the 10 communities are divided into two groups of five based on their size, a clear difference emerged in the number of communities recommending more than one action for renewable energy (Table 4). Only one of the five cities with a population over 50,000 (Calgary) recommended more than one renewable energy technology (bio-fuel, wind, solar thermal and solar PV). The four other urban CEPs only recommended action to introduce bio-fuels. Other renewable sources of energy were considered to need further research by these cities (Table 5). In contrast, three of the five smaller communities recommended action to support three or four different sources of renewable energy. The two other small communities identified wood as an important renewable energy source. The desire to reduce dependence upon high cost, carbon-intensive diesel generation in some small and remote communities can be a driver for changing energy sources (e.g. micro-hydro in Deline or micro-hydro and solar energy in Wha Ti). Similarly, rural communities focussing on an attractive environment to promote tourism (e.g. Banff) may also place a premium on clean energy sources. The small number of CEPs available for review limits the strength of these observations, but they provide a valuable basis for further investigation into which communities are most likely to systematically introduce renewable energy.

## 7. Conclusion

Conclusions from this study of Canadian CEPs point to the clear evidence that communities chose to meet their energy planning objectives through improvements in energy efficiency and conservation more frequently than incorporating renewables into their energy mix. This occurs even though there is a strong argument in the literature that all three areas are important factors to consider in community energy planning. The CEP planning process typically included formal municipal support as well as incentives from national agencies (NRCan) or networks (FCM). The mix of stakeholders and level of citizen participation varied. The driving goal in most CEPs was to reduce GHG emissions with more ambitious targets set for municipal operations and less stringent targets set for the broader community. Demand side management through energy efficiency and conservation received far more attention than renewable supply options. Although CEPs are identified in the literature as a mechanism to promote renewable energy, the current generation of CEPs in Canada provides only a modest step in this direction.

The most common choice among renewable energy options was bio-fuels (e.g. ethanol and bio-diesel). Wind, bulk 'green' electricity purchases, passive solar design, solar thermal and solar PV were each recommended by a couple communities. However, Calgary was the only one of five cities (population over 50,000) to recommend more than one renewable source of energy in its CEP. In contrast, the smaller rural and remote communities demonstrated a greater interest in multiple sources of renewable energy with three of the five communities proposing action for three or four different renewable energy sources. This suggests that smaller and more remote communities are more likely to promote multiple renewable energy technologies and serve as early adopters of distributed renewable energy systems in Canada.

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